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ABSTRACT

This instructional unit is one of 10 developed by students on various energy-related areas that deals specifically with the use of electricity. Its objective is for the student to be able to discuss consumer uses of electricity and understand increased usage and problems relating to needs for production expansion. Some topics covered are major areas of consumer electrical energy consumption, household energy savings, problems in electricity production, transmission of electricity, and power plant requirements. Material in each unit may include some or all of the following: terminal and specific objectives, list of references, information sheet with terms and definitions, informative materials, transparency masters, assignment sheet(s), and unit test with answers. (YLB)

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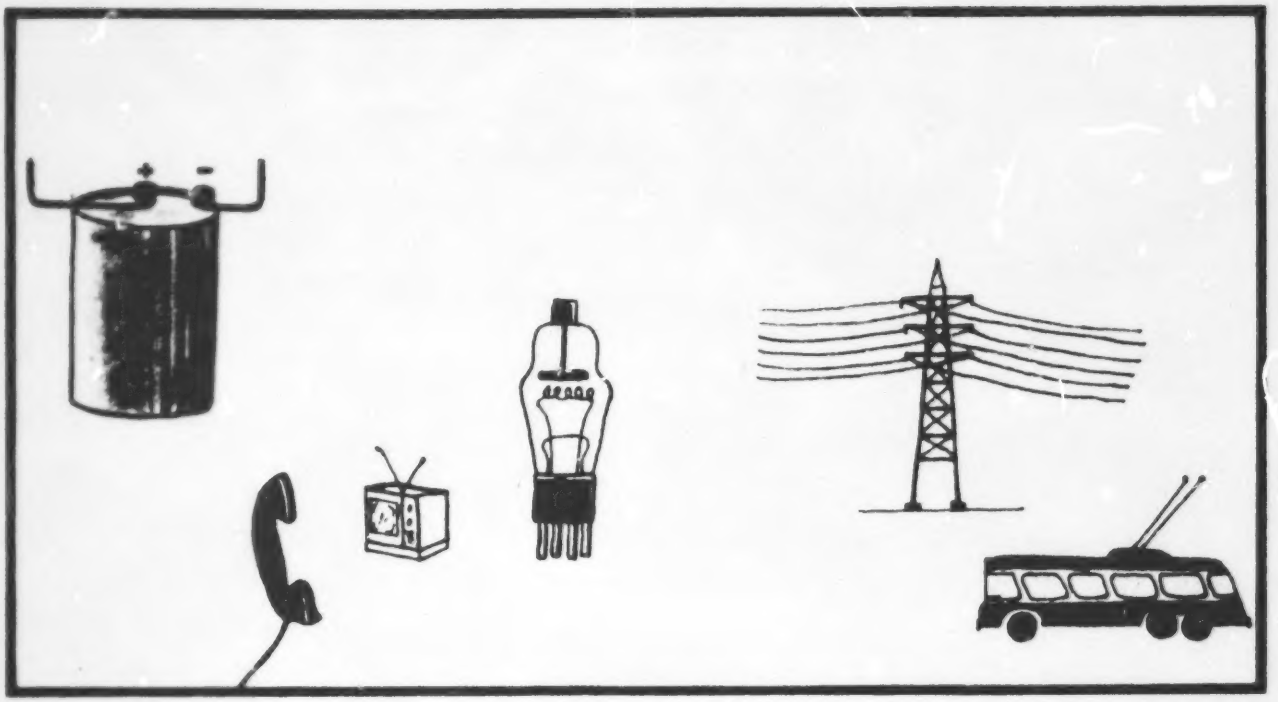
ELECTRICITY AND ITS USE



by

Ron Crank

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ELECTRICITY AND ITS USE

TERMINAL OBJECTIVE

Upon completion of this unit, the student will be able to discuss the various consumer uses of electricity including understanding of increased usage of electricity and problems relating to needs for production expansion.

SPECIFIC OBJECTIVES

After completion, the student will be able to:

1. Discuss the major areas of electrical energy consumption by consumers.
2. Select factual information from non-factual information concerning use of electricity by consumers.
3. List the basic options of energy use.
4. List three benefits to society of decreased consumption of energy.
5. Name the five general areas that use energy most extensively in the residential sector.
6. Discuss the concept of "energy-mindedness" and give two practical examples of it.
7. Select plant requirements for new power plants from a given list of possibilities.
8. Discuss the concept of "peaking" as it applies to the use of electrical energy.

ELECTRICITY AND ITS USE

INFORMATION SHEET

I. Terms and Definitions

A. Cooling Tower, Dry - A heat exchanger in which the heat in water is transferred to the air through a radiator device. The automobile radiator is one such device.

B. Cooling Tower, Wet -- A unit or structure, usually built of wood, for the cooling of water by evaporation.

C. Joule -- The work accomplished when a force of one Newton acts through a distance of one meter (1 Joule = 1 Newton-Meter)

D. Kilowatt -- Unit of power, commonly used as the commercial measure of electric power. Equivalent to 1000 watts or 1000 joules per second.

E. Kilowatt hour -- Measure of energy or work equal to that done by one kilowatt acting for one hour.

F. Kilovolt -- Unit of electric potential difference, equal to 1000 volts. In transmission of electricity, voltage is roughly analogous to pressure in the transmission of fluids.

G. Magnetohydrodynamics (MHD) -- Science related to phenomena arising from motion of electrically conducting fluids in the presence of electric and magnetic fields. Technique for generating electricity directly by moving liquids or gases through a magnetic field.

H. Megawatt -- Unit of power equal to 10^6 watts.

I. Spray Canals -- A cooling system using floating spray modules in a canal (or channel) to cool water by evaporation.

J. Thermal Power -- Energy generated through the use of heat energy.

K. Thermal Power Plant -- Any electric power plant which operates by generating heat and converting the heat to electricity.

L. Thermionic Device -- Device which converts heat into electricity by "boiling" electrons from a hot metal surface and condensing them on a cooler surface.

M. Volt -- Unit of electromotive force or electric potential difference.

N. Voltage -- Difference of potential measured in volts.

O. Watt -- Unit of power. Rate of energy use or conversion when one joule of energy is used or converted per second.

References:

A. Steinhart, Carol and John. Energy Sources, Use and Role in Human Affairs. North Scituate, Massachusetts; Duxbury Press, 1974.

B. Marion, Jerry B. Energy in Perspective. New York; Academic Press, 1974.

C. Fisher, John C. Energy Crisis in Perspective. New York; John Wiley and Sons, 1974.

ELECTRICITY AND ITS USE

U.S. Energy Use

In order to conserve energy, Americans need to learn about their energy consumption. Americans need to know their "energy patterns". Then, with this knowledge, they will be able to make intelligent changes. This allows for two options in energy use. One is to find ways to supply more energy. The other way is to curb the demand. Involved in reducing use of energy is the need to improve technology to increase efficiency.

Slowing down the growth rate is one way to meet the "energy crisis". There are several benefits to slowing down the growth rate. It gives more time to supply the energy that is needed. It conserves the present fuels for needs of the future. For each gallon of fuel not consumed means less pollution to control. This in turn reduces the energy needed to control pollution.

All this seems to make sense. But there is a major problem to conserving energy. The problem comes in the public being unable to relate growth of energy use in their own lives. For one thing, the public does not react to the statistical idea of energy use because it is so abstract. The public does not see how the numbers relate to a people problem. Most people have little idea of how much energy they use. Also, they do not realize how much energy they waste that could be conserved.

The changes in the last two generations are staggering. Not only has the population greatly increased but life styles have changed, too. Automation has taken over. There are numerous appliances and gadgets, all using some form of energy to use, to make life easier for the

people. If the item makes life easier, it also increases the speed in which an activity or job can be done leaving the people with more hours for recreation. There is a general belief that this increased number of appliances is responsible for an excessive increase in energy use. The bulk of residential energy is still used for space heating or cooling and the storage and preparation of food.

Space heating is the biggest user of energy. Space heating is about 57.5 percent of the energy used in the residential sector. The fastest growth of energy use has been electric heating. Between 1960 and 1968 the use of electric heat represented 1/3 of the increase in household heating. Increase in energy use in space heating was due to a general increase in building larger houses. Also, low efficiency of fuel use in electric heat growth could increase domestic energy needs enormously.

Water heating is the second largest use of energy in the residential area. By 1976, 65 percent of all residences had waterheaters. Energy consumption per household increased by a little over 5 percent. This increase was partially due to the growing number of dishwashers and washing machines.

Refrigeration and cooking of food use about equal amounts of energy. Combined they use 1.5 percent. Their energy use is significant to the way we feed ourselves. Energy use of ranges declined by 3-4 percent during the 1960's. This reflects not only changes in cooking habits but also of eating habits. The recent trend has been to use more pre-cooked and instant foods. Also, more meals are being eaten outside the home. While energy use in ranges has decreased, energy use for refrigerators has increased. This increase is partially due to the growing popularity of frostless refrigerators. Frostless

refrigerators require about 50 percent more energy to operate. The average storage capacity of refrigerators has increased in recent years. However, improvements in insulation technology has aided in reducing energy use by refrigerators. Thus, the energy needed by increased capacity has been reduced by better insulation.

Air conditioning has used 3.7 percent of residential energy. The energy growth rate in residential air conditioning for the 1960's was 16 percent. Most new homes have been designed for central air conditioning. When a house or building has been designed to use central air conditioning, it is difficult to cool it by any other method. The design does not allow for open window cross-ventilation. It is not designed for the use of fans either.

The use of clothes dryers has been expanding. This use now represents 3.7 percent of household energy. By 1975, 60 percent of all homes had clothes dryers. There had been a rise in use of electric dryers and a decline in the use of gas dryers. Here again, is a sign of the change in life style. The convenience of putting clothes in the dryer and then doing something else has changed America's life style, too.

These are just a few ways in which Americans use energy. We need to look at all aspects of using energy. The food we eat and the clothes we wear are two products of energy. The construction and operation of the houses in which we live is another. Energy is used in the production of and in the use of all consumer goods. This includes the luxuries as well as the necessities. We use energy in all forms of transportation, whether for business or pleasure. We use energy in recreational activities. There are several public users of

energy. The most tragic use of energy is the loss of energy during conversion processes.

For years, energy was believed to be ample and cheap. This belief resulted in energy being wasted by millions of Americans. It is not easy to change society and their views on energy. It is hard to change old habits into new habits. But Americans are going to have to change their ways as the limits on the fossil fuels are already visible. As a result, energy prices are rising, forcing Americans to change their habits.

Household Energy Savings

Each American family can save energy in many ways with only slight adjustments. The main benefit to the family is the amount spent on energy consumption would be lowered.

There are several ways to conserve energy in home heating. Lowering the temperature setting by one degree will reduce fuel use by 3 to 4 percent. Lowering the night time temperature setting 5 to 10 degrees and day time temperatures 3 degrees reduces consumption by 15 percent. Up to 25 percent can be saved through increased efficiency of furnaces by keeping them in good condition. The furnace should be serviced once each year before using. Top insulation could reduce fuel needs by more than 40 percent. (This would also effect cooling needs.) Monitoring ventilation to stop heat loss will save fuel, also. Alternate methods of home heating such as solar units will help save fuel. These few measures, if followed, could reduce the national fuel consumption by 8.6 percent. Up to two percent of the nation's fuel consumption could be saved if hot water heaters were converted to solar water heaters.

Changes in refrigeration and cooking usage could be affected by

both the manufacturer and the consumer. The manufacturer can modify the design to be the most energy efficient. They can provide the consumer with information on the appliance's energy use. It would then be up to the consumer to use the appliance in the most energy efficient way for him.

Air conditioning is the fastest growing use of energy. Quality insulation will help save energy. Using air conditioning only when really needed will help, also.

Small savings of energy consumption are encouraged. For instance, turn off the lights when not needed or turn off stereos and television sets when not in use. It has been suggested that the best way for Americans to learn to conserve energy is to increase its price. So far, this has been true of gasoline. (But should we learn to conserve at the expense of those that can't afford the high prices?) The above measures have been estimated to save up to 12 percent of energy consumption in the U.S. A government report estimates that less ambitious measures could save 5.3 percent of expected consumption in 1980-1981.

U.S. Production of Electricity

Electricity is the most convenient and versatile form of energy. Electricity is not a primary source of energy, but it is produced from one of the primary energy sources. Thus, it loses energy in the conversion process. The production of electricity creates new markets for the primary energy sources. At the same time it takes away traditional markets for them. For example, the current trend is toward electric space heating. Also, electric furnaces are being used for the production of steel. The internal combustion engine is the only one holding its own against electricity.

In 1970, 23 percent of the energy used by the U.S. was for generation of electricity. Since World War I, the use of electricity has been doubling every eight to ten years. A similar rate is projected for the future. In the use of energy, in general, the rate is doubling every 16 to 20 years. If this trend continues, by 2040 this country will have an all-electric economy.

There are problems in the production of electricity that are shared with other energy industries. These problems are: (a) technological, (b) environmental, (c) political and (d) economic. The problems which are unique to the production of electricity are: (a) generation, (b) distribution, and (c) use of electricity.

The increase in the generating capacity is matched by the increase in the size of the generating units. The trend is toward using a number of units in a central power station.

As the people use more electricity, so is there a need for new power plants. There are many problems in building new power plants. The site selection for new power plants is meeting opposition. The opposition for the sites include ecological interests and emotional reasons.

Because habits do not change overnight, the growth rate for electricity will continue. So the U.S. will continue to need increasing amounts of electricity for the next few decades.

There are several items which new power plants require. Good highway access is necessary for construction of the new plant. The good highways are needed to maintain the plant. Transportation by rail or air for delivery of equipment and primary source fuels. When roads aren't available, they will have to be constructed. So this cost must be considered into the total cost of the plant. There are other

environmental factors to be considered, also. The design of the plant must reflect such environment happening as earthquakes or weather factors. The weather factors to be considered in the plant design are tornadoes, hurricanes, ice storms and sand storms. There should be plenty of water for cooling. The plants require large amounts of land. Each plant consists of the power house, equipment for controlling air pollution, fuel storage, rail, barge and truck terminals, and transmission access and switchyards.

The area of the country will help decide the design of the plant. Also, the area of the country aides in deciding the type of plant to be built. The northeast and midwest are leaning toward nuclear power. The south central region will be fossil-fueled. The northwest is adding hydroelectric installations with a shift toward thermal power. The northeast and southeast are expected to use large amounts of pumped storage fuels. These patterns reflect an adequate fuel supply for the life of the plant. They are also practical and economic for use.

There are other questions to be answered in choosing a site for building a new power plant. Should it be located near or far from the population centers it serves? Should they transport the fuel to the power plant or build it where the fuel is produced? There are two arguments for building away from the population. The environment is better capable of taking care of pollution. By building away enables the plant to serve other places, too. There are two arguments against building away from the population. The people do not want to destroy the remaining wilderness areas. There is increased economic and environmental cost of transmission. Any potential use of waste heat could not be realized.

The largest problem to the electric power industry is waste heat. The efficiency of the plant is only 33 percent. This means that it is 66 percent inefficient. For now waste heat is inevitable. It seems that the steam cycle in the conversion process is the culprit.

This waste heat needs to go somewhere. So it goes into the atmosphere. From there it goes on out into space. Two things happen then. The waste heat effects water resources and thermal pollution occurs. Water temperatures effect all water dwellers from plankton to game fish. Disturbing the natural balance of nature usually has some negative effects on the total ecosystem.

At the present time, the disposal of most of the waste heat is done by one-through cooling method. The waste heat is them emptied by way of five different methods. Waste heat is dumped directly into the available bodies of water such as a lake or river. Wet cooling towers discharge waste heat directly into the atmosphere. This method has three disadvantages. In the process of evaporation it may produce local fog. It increases the rainfall in the area. It also depletes the source of cooling water. The other three methods are the use of dry cooling towers, cooling ponds and spray canals. All of these recycle some of the cooling water. There is no ideal solution to the problem of waste heat. The situation is a trade-off between economy and environment. A compromise is needed between them.

Some ways for using waste heat have been developed. Some waste heat could be used for purposes where mild temperatures are okay. In urban areas, the waste heat could be used as energy for space-heating in the winter. In the summer, it could be used as energy for air conditioning. Combining power plants and sewage treatment plants may be feasible. The sludge from the sewage treatment plant could be

used as fuel for the power plant. The sludge would burn cleaner than coal. Waste heat could be used to de-fog and de-ice airports. It could be used to warm greenhouses. It could even be used in fish hatcheries and shellfish farms.

Transmission of Electricity

The transmission of electricity is expensive. It takes up space and uses lots of materials. The cost for the development of high voltage transmission industries is relative to the cost of transporting fuel.

Electric power is the product of electric current and electromotive force. Electric current is the rate of the flow of electric charge. Electromotive force is the voltage which is roughly analogous to pressure. As voltage increases, more energy is transmitted. Some energy is always lost during transmission. Part of this loss is due to the resistance of the wire. The amount lost is related to the amount of current. Some is lost at the cross sectional area of wire. The higher the voltage is increased, the wire has increased capacity. So the size of the wire can be decreased. Then the heat loss due to resistance will be decreased. At high voltage, another kind of energy loss occurs. This loss is called corona discharge. Energy is lost when the air around the transmission lines become ionized. (see TM)

The transmission system requires a great deal of lines. A typical system begins with a 3000 mega watt plant. This is connected by lines into a transmission system at 500 kilowatts. This requires a right-of-way of 25-40 hectares for each kilometer of line.

The plants are being pressured to lay transmission lines underground. People think that if the phone company can lay underground

lines, so can power plants. However, there are many technical problems to be solved first. It is also currently too costly.

Efficiency and Peak Demands

The supply must immediately meet the demand. There are variations in the amount in demand. This demand usually comes in cycles, so planning is made easier. The cycles of demand vary with the uses of electricity and the climate. These cycles are daily, weekly and seasonal. At times the electric power industry has trouble in finding ways to meet peak demands. Another problem they have is in using the generating capacity when demand is low. Power systems work most efficiently and economically at full load. For this reason, power companies encourage off-peak use of power. Also, power systems with east-west connections on their system have an advantage. As peak demand crosses the time zone, the power system can generate electricity at full load for a longer time. This makes it more economical to run the power system.

Additional generators are used at peak times to meet the extra demand. Gas turbines and diesel engines are also used to boost supplies. There are other technologies being considered to help meet peak demands. These include topping-bottom cycles and magnetohydrodynamics. They are trying to burn fossil fuels in pre-heated air in a high temperature combustion chamber. They are also trying to convert heat directly to an electric current. Another method is the thermionic effect of boiling off electrons when metal is heated beyond a certain point.

There are four major elements to be considered in the cost of electricity. They are: (1) cost of fuel, (2) cost of capital (3) cost of operations and maintenance (4) cost of transmission losses.

Capital is needed for generation equipment, for transmission equipment and for distributior equipment.

The cost of new power plants are rising. Primary source fuels are getting scarce. It is up to the American people to cut back on using electricity, or at least not everyone using it at peak-demand times. This will slow down the growth rate and lengthen the time for the fuels we have. In this way, the power companies and others may look for alternate ways of generating power. They can also have time to discover ways to harness waste heat and use it.

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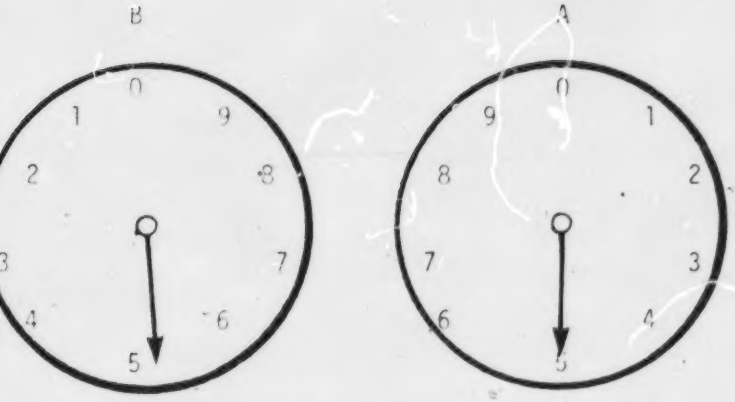
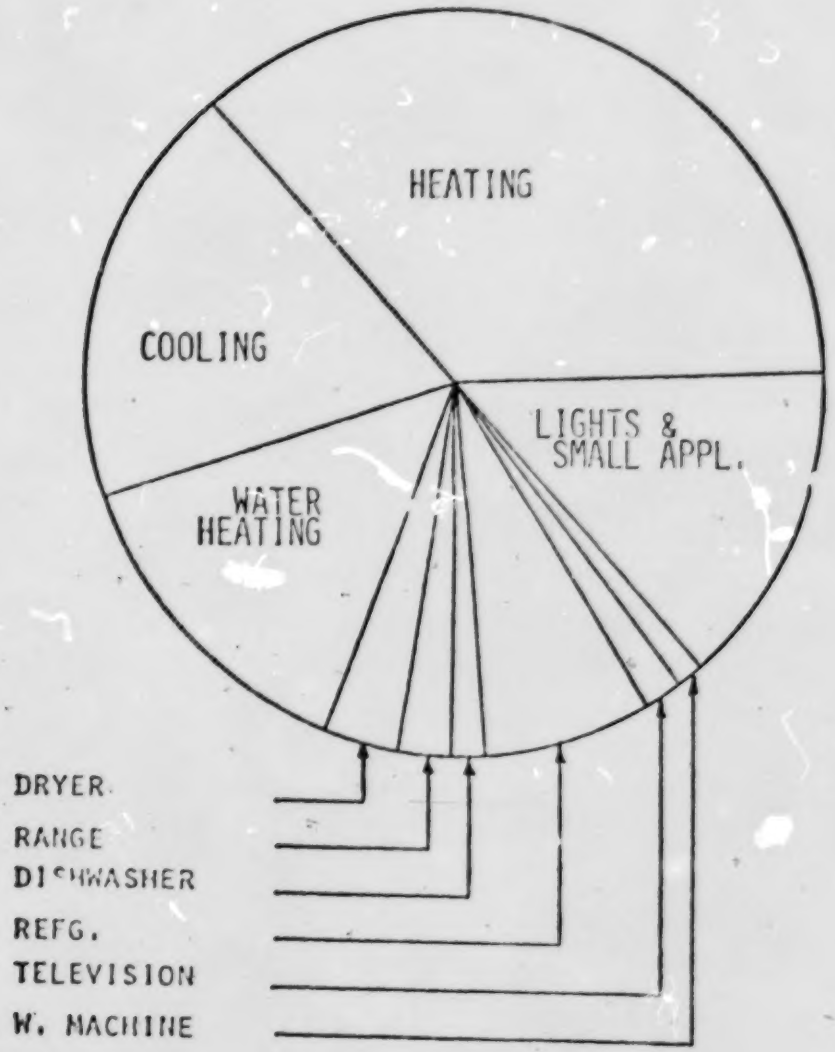
17

TT-HOUR METER

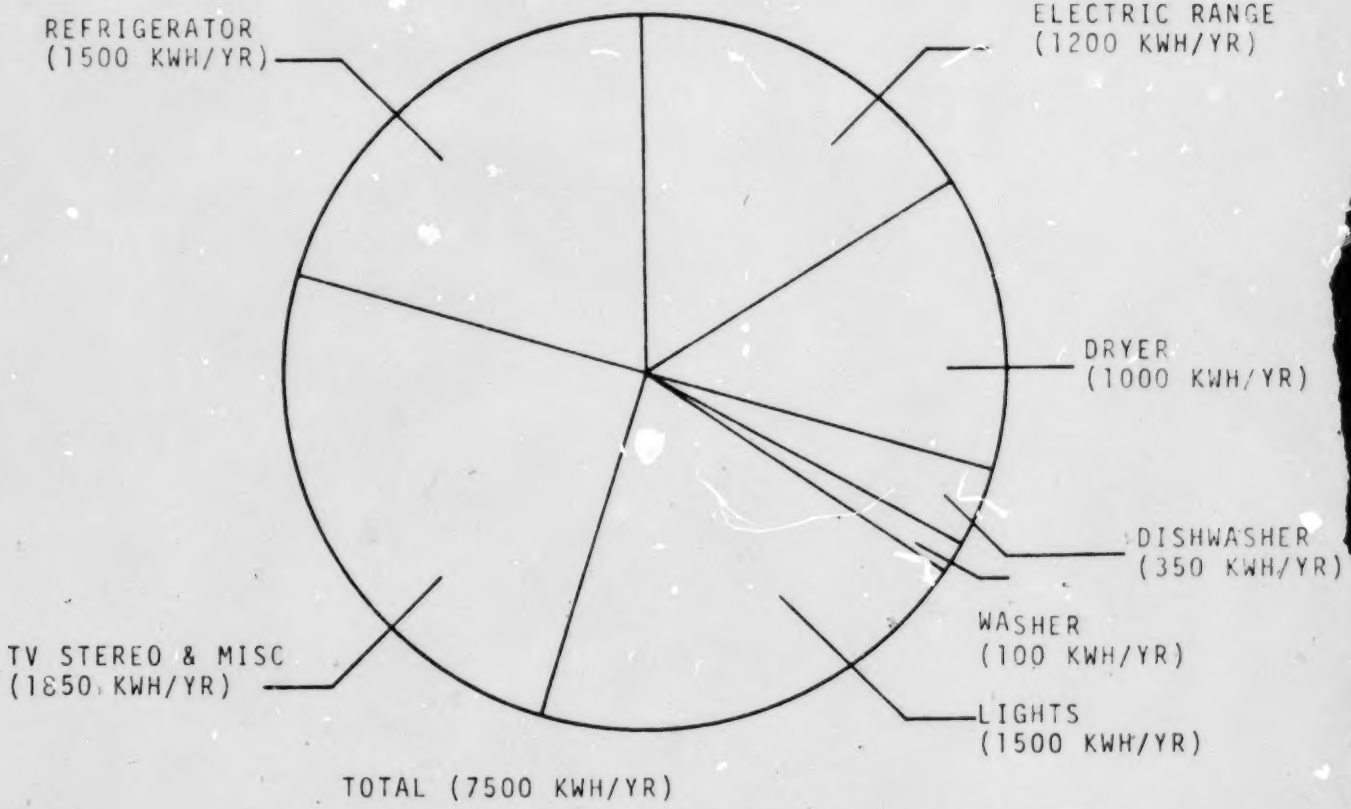


AVERAGE ANNUAL KWH
BY APPLIANCE



SOURCE: Texas Power and Light Company

APPLIANCE AND LIGHTING ENERGY FOR A TYPICAL FOUR-PERSON FAMILY



TOTAL (7500 KWH/YR)

SOURCE: EUGENE ECCLI, LOW-COST, ENERGY-EFFICIENT SHELTER FOR THE OWNER AND BUILDER, 1976.

ELECTRICAL APPLIANCE ENERGY TABLE

Appliance Wattage Rating	Kilowatt-Hours of Energy Used Per Hour	Ounces of Oil Burned Per Hour	Ounces of Coal Burned Per Hour
10	1/100	1/10	13/100
25	1/40	1/4	33/100 (or 1/3)
40	1/25	2/5	1/2
60	3/50	3/5	4/5
100	1/10	1	1-1/3
150	3/20	1-1/2	2
200	1/5	2	2-2/3
300	3/10	3	4
500	1/2	5	6-2/3
750	3/4	7-1/2	10
1000	1	10	13-1/3
1500	1-1/2	15	20
2000	2	20	26-2/3
5000	5	50	66-2/3

SOURCE: THOMAS ALVA EDISON FOUNDATION

HOUSEHOLD APPLIANCES

FOOD PREPARATION	AVERAGE WATTAGE	EST. KWH CONSUMED MONTHLY
Blender	300	0.1
Broiler	1,140	7
Carving Knife	92	0.1
Coffee Maker	1,000	1.0
Crepe Maker	894	9
Deep Fryer	1,448	7
Dishwasher (2 loads)	1,201	30
Double Hamburger Maker	750	.75
Egg Cooker	516	1
Food Processor	360	.17
Frying Pan	1,196	8
Hot Plate	1,200	8
Mixer	127	0.2
Oven, Microwave (only)	1,450	16
Range		
with oven	12,200	98
with self-cleaning oven	12,200	100
Roaster	1,333	5
Trash Compactor	400	2
Waffle Iron	1,200	2
Waste Dispenser	445	2

SOURCE: TEXAS POWER & LIGHT COMPANY

	AVERAGE WATTAGE	EST. KWH CONSUMED HOURLY
COMFORT CONDITIONING		
AIR CLEANER	50	.05
AIR CONDITIONER (ROOM)		
12,000 BTU	1,600	1.6
BED COVERING	177	.177
DEHUMIDIFIER	257	.257
FAN (ATTIC)	370	.370
FAN (CIRCULATING)	88	.088
FAN (ROLLAWAY)	171	.171
FAN (WINDOW)	200	.200
FURNACE FAN	500	.500
HEATER (PORTABLE)	1,322	1.322
HEATING PAD	65	.065
HUMIDIFIER	177	.177

COMFORT CONDITIONING -- SINCE THE TYPE AND SIZE OF COMFORT CONDITIONING EQUIPMENT IS WIDELY VARIED, ELECTRICAL CONSUMPTION DIFFERS GREATLY FROM ONE INSTALLATION TO ANOTHER. FOR DETAILED INFORMATION ABOUT YOUR EQUIPMENT, ITS USE AND CONSUMPTION, CONTACT THE LOCAL TEXAS POWER & LIGHT COMPANY OFFICE. THE ABOVE LISTINGS ARE ONLY AVERAGES AND ESTIMATES.

FOOD PRESERVATION	AVERAGE WATTAGE	EST. KWH CONSUMED MONTHLY
FREEZER (15-21 FT.)		
CHEST TYPE, MANUAL DEFROST	-	110
UPRIGHT TYPE		
MANUAL DEFROST	-	110
AUTOMATIC DEFROST	-	165
REFRIGERATORS/FREEZERS		
MANUAL DEFROST, 10-15 CU. FT.	-	58
AUTOMATIC DEFROST, 16-18 CU. FT.	-	150
AUTOMATIC DEFROST, 20 CU. FT. & UP	-	158

FOOD PRESERVATIONS -- THE WATTAGE AND CONSUMPTION OF FREEZERS AND REFRIGERATORS VARY ACCORDING TO MAKE AND SIZE. ADDITIONALLY, THE ELECTRICAL CONSUMPTION IS AFFECTED BY MANY VARIABLES: FAMILY SIZE, USAGE, ENVIRONMENT, ETC. THE TABLE ABOVE IS MERELY AN ESTIMATE BASED ON AVERAGE EQUIPMENT AND USAGE. MORE DETAILED INFORMATION ABOUT YOUR PARTICULAR APPLIANCE CAN BE OBTAINED THROUGH THE LOCAL TEXAS POWER & LIGHT COMPANY OFFICE.

	AVERAGE WATTAGE	EST. KWH CONSUMED MONTHLY
HEALTH & BEAUTY		
GERMICIDAL LAMP	20	12
HAIR DRYER	1,000	15
HEAT LAMP (INFRARED)	250	1
SHAVER	15	.004
SUN LAMP	275	1
TOOTH BRUSH	1.1	.1
VIBRATOR	40	.2
HOME ENTERTAINMENT		
RADIO (SOLID STATE)	10	1
RADIO/RECORD PLAYER	109	9
TELEVISION		
BLACK & WHITE		
TUBE TYPE	100	18
SOLID STATE	45	8
COLOR		
TUBE TYPE	240	44
SOLID STATE	145	27
HOUSEWARES		
CLOCK	2	1.4
FLOOR POLISHER	305	1
SEWING MACHINE	75	1
VACUUM CLEANER	630	4

HOUSEHOLD APPLIANCES (CONT.)

LAUNDRY	WATTAGE AVERAGE	EST. KHW CONSUMED MONTHLY
CLOTHES DRYER (8 LOADS PER WEEK)	4,856	83
IRON (HAND)	1,100	5
WASHING MACHINE (AUTOMATIC)	512	9
WASHING MACHINE (NON-AUTOMATIC)	286	6
WATER HEATER	4,500	300-500

ELIMINATING UNNECESSARY APPLIANCES

Electric Appliances	Kilowatt Hours Consumed Annually	Substitute
Blender	15	Egg beater and strong arm
Carving knife	8	Sharp knife
Coffee maker	106	Do without
Dishwasher	363	Wash dishes by hand
Egg cooker	14	Cook eggs in boiling water used for tea or coffee
Garbage disposal	30	Compost food waste
Trash compactor	50	Manually shred trash and crush cans
Clothes dryer	993	Hang clothes to dry outside in summer and inside in winter (to help humidify)
Iron	144	Wear permanent-press clothing
Electric blanket	147	Sleep with extra blankets
Humidifier	163	Put a pan of water on the radiator, hang up wet clothes, or open the bathroom door after a shower
Portable heater	176	Heavier clothing
Hair dryer	14	Dry towel, strong arms
Germicidal lamp	141	Do without
Sun lamp	16	Go outside and enjoy the sunshine
Shaver	1.8	Grow a beard
Toothbrush	.5	Brush by hand
Vibrator	2	Physical exercise
Clock	17	Wind-up clock
Can opener		Manual can opener
Lawn mower		Hand-powered mower
Hedge clipper		Hand-powered clipper
Saw		Hand-powered saw
Paint mixer		Hand-powered mixer

SOURCE: CENTER FOR SCIENCE IN THE PUBLIC INTEREST

USES OF RESIDENTIAL ENERGY IN THE UNITED STATES

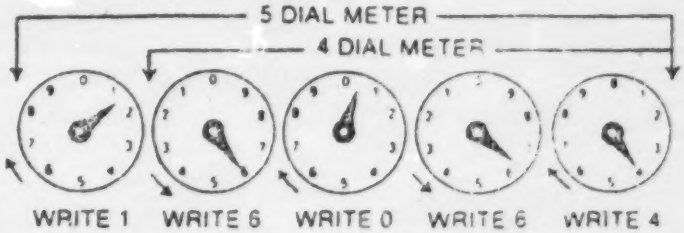
	Percent of total U.S. energy used	Amount of energy (in 10^9 kWh/y)
Space heating	11.0	2200
Water heating	2.9	580
Cooking	1.1	220
Refrigeration	1.1	220
Air-conditioning	0.7	140
Clothes drying	0.3	60
Other	2.1	420
Total	19.2	3.84×10^{12} kWh/y

ELECTRICITY AND ITS USE

Assignment Sheet #1

How To Read Your Electric Meter

The dials are like watch faces lined in a row (every other dial moves counter-clockwise). The reading for a five dial meter would be 16,064. The reading for a four dial meter would be 6,064.

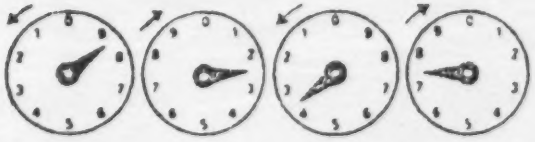


Notice that when the pointer is between two numbers, you should record the lower of the two numbers. When the pointer seems to be directly on a number, look at the dial to the right; if the pointer on the right side dial has passed "0", then write down the number the pointer seems to be on; if the pointer on the right side dial has not passed "0", then write down the previous lower number on the dial you are recording.

Record the Readings for the Following Meters

METER NO. 1

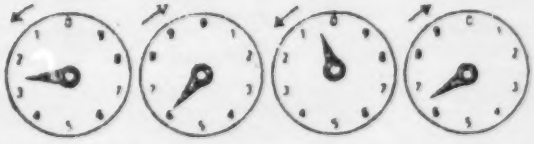
A _____



B _____

METER NO. 2

A _____



B _____

Subtract the number of line A from the number on line B to find the number of KWH of electricity used.

Line B _____ Line B _____

Line A _____ Line A _____

KWH Used _____ KWH Used _____

NAME _____

ELECTRICITY AND ITS USE

TEST

I. Circle "T" for true and "F" for false in the statements below.

T F 1. Most people have little idea of the actual amount of energy that they use.

T F 2. It is generally believed that more appliances and powered gadgets are responsible for the excessive increase in consumer use of energy.

T F 3. Fastest growing rate of energy use by consumers is for water heating.

T F 4. Affluence of society has little influence on energy expenditures.

T F 5. Increased use of electric heat accounts for increased growth of energy expenditure in space heating.

T F 6. Dishwashers and washing machines account for part of the additional energy use of water heating energy.

T F 7. Frostless refrigerators require up to 20 percent more energy to operate.

T F 8. The decline of energy used by ranges is related to changes in cooking and eating habits of Americans.

T F 9. Residential air conditioning energy increases may widen by new housing designed for central air conditioning.

T F 10. Houses which are designed to use central air are difficult to cool by other methods.

T F 11. Until recently, Americans have always believed that energy would be cheap and always available.

T F 12. Lowering temperature settings on home heating equipment has little effect on fuel conservation.

T F 13. Faulty maintenance of furnaces can affect efficiency up to 25 percent.

T F 14. Adequate insulation affects both heating and cooling efficiencies of structures.

T F 15. Solar water heaters have been recommended as an alternative to traditional water heaters.

T F 16. Increasing the price on the use of energy would have no affect on energy conservation.

T F 17. Government reports estimate that by individuals conserving energy, we could save up to 12 percent of energy usage in the United States.

T F 18. Electricity is a prime source of energy in the United States.

T F 19. Almost one-fourth of the energy used in the United States is used for generation of electricity.

T F 20. Continuing trends in electricity usage indicate that there will be an all-electric economy by 2050.

T F 21. Design standards of new power plants must take into consideration factors concerning acts of nature, such as tornadoes and hurricanes.

T F 22. Water supply is a minor consideration in production of new power plants.

T F 23. Power plants in the future will likely be designed to fit specific areas.

T F 24. The relationship of new power plants to population center locations is not a factor in planning a new plant site.

T F 25. Waste heat is a minor problem of the electric power industry.

T F 26. Most electricity producing power plants are rated about 33 percent efficient.

T F 27. Waste heat has been getting more attention in relation to its affect on water resources and thermal pollution effects.

T F 28. Some electricity is always lost during transmission.

T F 29. Technology can affect lifestyle; as shown by the acceptance of clothes dryer.

II. 30. From the list below select those which are necessary requirements for new power plants by placing a check mark beside it.

_____ Access roads

_____ Large amounts of land

_____ Mountainous terrain

_____ Population center nearby

_____ Fuel storage

_____ Supply of water

_____ Air pollution control equipment

III. 31. What are the options we have in view of the energy crises?

A.

B.

C.

32. Slowing the rate of growth in energy us will yield some direct benefits to society. List three benefits.

A.

B.

C.

33. What are the five major energy users on the residential level?

A.

B.

C.

D.

E.

34. What is meant by "peaking" as it applies to electricity?

ELECTRICITY AND ITS USE

ANSWER SHEET

I.

1.	T		16.	F	
2.	T		17.	T	
3.	F		18.	T	
4.	F		19.	T	
5.	T		20.	T	
6.	T		21.	T	
7.	F		22.	F	
8.	T		23.	T	
9.	T		24.	F	
10.	T		25.	F	
11.	T		26.	T	
12.	F		27.	T	
13.	T		28.	T	
14.	T		29.	T	
15.	T				

II. 30. List below contains factors that are necessary requirements for new power plants.

- ✓ Access roads
- ✓ Large amounts of land
- ____ Mountainous terrain
- ____ Population center nearby
- ✓ Fuel storage
- ✓ Supply of water
- ✓ Air pollution control equipment

III. 31. Three options considered in this unit for future use of energy.

A. Finding ways to supply ever increasing amounts of energy.

B. Curb the demand.

C. Improve technology to increase efficiency of usage.

32. Three benefits to society of slowing down consumption include:

A. More time to supply energy needed.

B. Conservation of current supply of fuels for need further into the future.

C. For each gallon not consumed - less pollution to control.

33. Five major energy consumers on the residential level include:

A. Space heating

B. Water heating

C. Food preparation

D. Food refrigeration

E. Air conditioning

34. "Peaking" is the variations in demand upon supply of electrical energy. Cycle of demand will vary with several factors including:

Use of electricity
Climate
Season
Time of day
Time of week